Motives for intervention

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I. Introduction

Central banks intervene in foreign exchange markets in order to achieve a variety of overall economic objectives, such as controlling inflation, maintaining competitiveness or maintaining financial stability. The precise objectives of policy and how they are reflected in foreign exchange market intervention depend on a number of factors, including the stage of a country's development, the degree of financial market development and integration, and a country's overall vulnerability to shocks. The precise definition of which operations in forex markets constitute "intervention" has also been a matter of controversy.[2]

Three immediate objectives of intervention have been important: to influence the level of the exchange rate; to dampen exchange rate volatility or supply liquidity to foreign exchange markets; and to influence the amount of foreign reserves. Much of the analysis in this paper draws on central bank responses to a questionnaire on foreign exchange market intervention and meetings with central bank officials and foreign exchange market participants.

II. Motives for intervention

Table 1 proposes a taxonomy of intervention that will be used to organise the discussion. Foreign exchange market intervention is driven by broad macroeconomic objectives shown in the column headers: to control inflation or maintain internal balance; to maintain external balance and prevent resource misallocation or preserve competitiveness and boost growth; and to prevent or deal with disorderly markets or crises. To achieve these objectives, central banks might seek to target the level of the exchange rate, dampen exchange rate volatility or influence the amount of foreign reserves.

The economic objectives of intervention will influence its targets, the indicators monitored and the tactics. For example, under a floating exchange rate regime, if the concern is with inflation, the estimated pass-through from exchange rate changes to inflation is relevant, and the behaviour of the nominal exchange rate will be monitored with a view to preventing sharp changes (ie dampening volatility). If external balance is the primary concern, the real exchange rate and the current account, and factors that may influence these variables, such as the terms of trade or capital flows, will be monitored. If the concern is with financial stability and crisis prevention, then market conditions (some cited in Rhee's paper on Korea in this volume) can be highly informative, including: how fast the exchange rate changes; the size of exchange rate volatility; bid-ask spreads; transaction volumes; and the exposure of different market participants. Determinants of the nominal exchange rate, such as portfolio flows or forward market transactions, would also be closely watched. Tactics - and the approach to intervention (leaning against the wind, dampening overshooting, etc) - may be heavily influenced by these same market conditions or by other indicators. Over a longer time horizon, in gauging the appropriate level of reserves needed for purposes of intervention, an assessment of whether capital flows are temporary or permanent can be helpful.

[1] Valuable comments by David Archer, Philip Turner and William White are gratefully acknowledged.

[2] This issue is reviewed in Annex 1.

Table 1

Taxonomy of foreign exchange market intervention

	Macroeconomic objectives		
	Control inflation and internal balance	**External balance, growth, efficient resource allocation**	**Maintain financial stability (Prevent disorderly markets or crises)**
Specific intervention objectives			
A. Influence the exchange rate level (pegs, bands, crawls, announced or unannounced)	X	X	X
B. Dampen volatility under floating	X	X	X
i. Respond to volatility symmetrically			X
ii. Prevent excessive movements or overshooting (no fixed target)	X	X	X
iii. Resist too rapid movements	X	X	X
iv. Maintain liquidity in foreign exchange markets			X
C. Influence the amount of foreign reserves			X

In his paper on the Czech experience for this volume, Holub makes the important point that procedural rules for foreign exchange intervention under managed floating with inflation targeting are difficult to define, in contrast to clearly defined procedures for adjusting interest rates. To the extent that such rules exist, they are seldom revealed, complicating the analysis of motives for intervention.

A. Intervention to influence the level of the exchange rate

In the early 1990s, many emerging market economies maintained (de facto or de jure) pegged or managed exchange rate regimes, which were intended to target the level of the exchange rate or limit fluctuations within a band. These arrangements were supported by monetary policy and exchange market intervention. In some cases, such as Hong Kong, Argentina, the Baltic states and Bulgaria, foreign exchange operations would support a peg under a currency board arrangement. Several economies in East Asia (eg Malaysia and Thailand) maintained basket pegs which closely resembled pegs to the dollar. Crawling (depreciating) bands were a feature of pegged exchange rates in Mexico and Indonesia before their respective crises in 1994 and 1997. However, exchange rate pressures could go in either direction: Chile, Israel and Singapore have experienced appreciation pressures within their bands over certain periods. Even countries with officially more flexible regimes limited exchange rate movements: under Korea's "market average exchange rate system" adopted in 1990, daily exchange rate movements were limited within certain bands.[3] Many pegged exchange rate

[3] Goldstein (2002) provides an overview of different approaches to pegging in the 1990s.

arrangements collapsed after the Asian and Russian crises of 1997-98. However, there are important exceptions: pegs have been maintained in China and Hong Kong while Malaysia reverted to a fixed rate in 1998.

Why does the official sector target the exchange rate? Three reasons may be cited. First, to control inflation or maintain internal balance. Some countries have controlled inflation by using the exchange rate as a nominal anchor for monetary policy. For example, the adoption of Argentina's currency board and of Brazil's quasi-fixed exchange rate regime in the early 1990s ended periods of very high inflation in these economies. The use of the exchange rate as a nominal anchor has declined, but the issue remains important for China as it considers approaches to liberalising its exchange rate regime. Other countries (eg Chile, Israel and Singapore) have controlled inflation by using an exchange rate path (announced or unannounced) as an indirect or operational target to control inflation, or in support of monetary policy. The exchange rate was not necessarily the nominal anchor as these policies were implemented to support inflation targets.

Second, to achieve external balance or enhance competitiveness and boost growth. Exchange rate targets have been used to prevent real exchange rate misalignment and achieve external equilibrium (eg in Korea until 1997). Often, a goal has been to prevent real exchange rate appreciation and large current account deficits that can be perceived as unsustainable and suddenly reverse.[4] As discussed below, others may have set exchange rates to enhance competitiveness.

Third, to prevent crises. If there are significant currency mismatches in the economy so that foreign currency liabilities are not fully backed by foreign currency assets or earnings, a currency depreciation can adversely affect the financial position of financial institutions or firms that borrow in foreign currency. A sufficiently large depreciation could weaken the financial sector or even trigger a financial crisis under these conditions.

A number of issues arise from these experiences.

First, what roles should exchange rate intervention and interest rate adjustment play in implementing monetary and exchange rate policy? For a time, Israel relied exclusively on foreign exchange market intervention to maintain a pegged exchange rate. It then switched to an interest rate instrument to achieve an inflation target while relying on foreign exchange intervention to keep the exchange rate on target (however, it has not intervened since 1997). Hong Kong has resorted to unsterilised intervention in the foreign exchange market under its currency board-style arrangement (see Sokoler's paper on Israel and Pang's paper on Hong Kong in this volume, Gerlach et al (2004)).

Second, what exchange rate level should be targeted? There are differing views on this. The traditional view is that the exchange rate level should be set so as to achieve external balance. However, exchange rate determination models are poor and criteria for judging external balance vary, so there can be disagreements on the extent to which the exchange rate might be misaligned.[5] Others use purchasing power parity (PPP) as the criterion for equilibrium, but estimates can also vary considerably. In some countries, deviations from PPP appear to persist for extended periods.[6] Still others argue that exchange rate policy should pursue development goals. In this view, some Asian countries have targeted the dollar and kept currencies undervalued in an effort to maintain external competitiveness, attract foreign direct investment and boost exports and growth (Dooley et al (2003, 2004a)). The resulting accumulation of foreign reserves could be seen as collateral to attract foreign investors (Dooley et al (2004b)). From this perspective, low returns or even losses on such reserves would not necessarily be a concern given the growth and development benefits. In line with this, Graph 1 shows that real exchange rates for many emerging market economies do not show a

[4] Current account deficits have recently turned to surpluses in a number of emerging market economies, but intervention to resist appreciation has continued in some cases. In other cases, questionnaire responses indicate that central banks monitor behaviour of the real exchange rate and the current account, even if they do not use these as criteria for intervention.

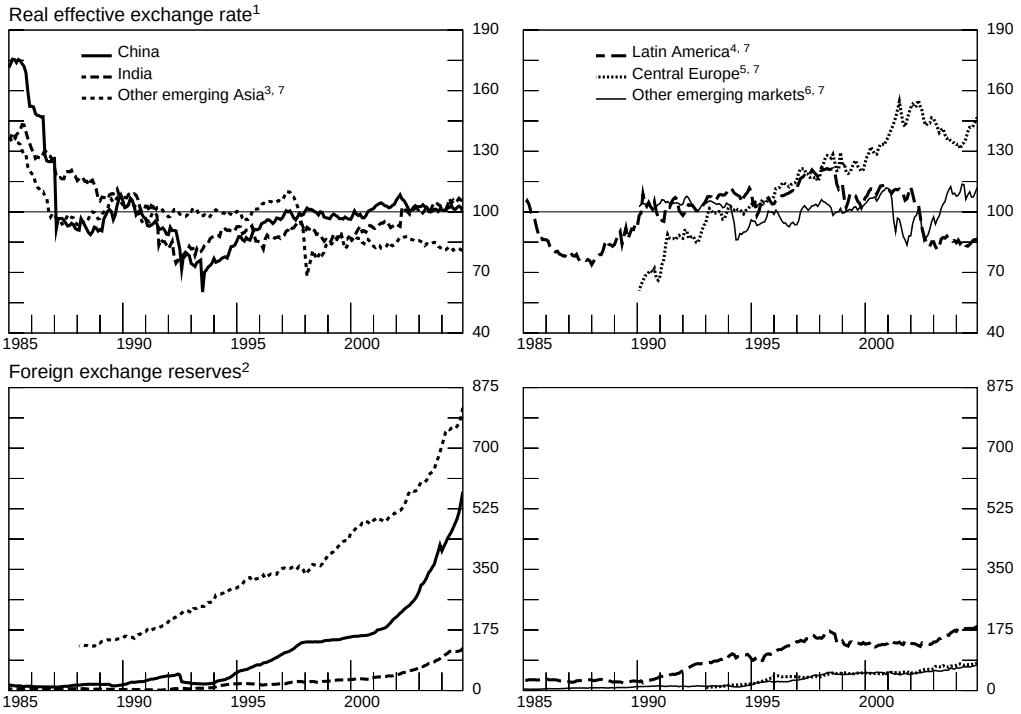
[5] In contrast, Goldstein (2004) argues that the balance of payments surplus in China reveals significant exchange rate misalignment and the need for a significant appreciation in the exchange rate.

[6] PPP estimates suggest that the nominal exchange rates are undervalued in a number of Asian economies. However, these estimates vary widely; in China they range from estimated undervaluation by a factor of 4 to undervaluation of 40%. Also, deviations from purchasing power parity in Asian economies appear to be more persistent than suggested by empirical studies indicating convergence to PPP in about four or five years (Frankel and Rose (1996)).

tendency towards appreciation in the medium run, which might have been expected given the rapid expansion in tradable goods capacity and, in many cases, significant balance of payments surpluses. Also, foreign reserves have risen very sharply as a result of heavy intervention in China and other emerging Asian economies.

Graph 1

Real exchange rates and foreign exchange reserves



[1] 1985-99 = 100; in terms of relative consumer prices. An increase indicates an appreciation. [2] In billions of US dollars. [3] Hong Kong SAR, Indonesia, Korea, Malaysia, the Philippines, Singapore, Taiwan (China) and Thailand. [4] Argentina, Brazil, Chile, Colombia, Mexico, Peru and Venezuela. [5] The Czech Republic, Hungary and Poland. [6] Israel, South Africa and Turkey. [7] For foreign exchange reserves, sum of the economies listed; for others, weighted average of the economies listed based on 2000 GDP and PPP exchange rates.

Sources: IMF; national data; BIS calculations.

For other emerging Asian economies, the gains from targeting the exchange rate no longer appear to be as clear-cut as suggested by Dooley et al. One reason is that the costs of preventing appreciation have risen. Inflation is higher in emerging markets that have intervened to stem currency appreciation, as are domestic interest rates, raising the carrying costs of holding foreign exchange reserves (see the discussion below and the contribution by Mohanty and Turner in this volume). Another reason is that while real exchange rates have depreciated in these economies the region has not preserved its lead in global exports or prevented the relocation of production to China. Thus, exports have fallen well below China's, and are even below Latin America's (where exchange rates appear to be much more flexible). Net FDI has also fallen off sharply, and recent research suggests that FDI to China displaces (in relative terms) FDI to other Asian economies (Chantasasawat et al (2004)).[7] It is worth highlighting that these developments are not all negative: they have been associated with the development of

[7] The authors find that the level of Asia's (excluding China) FDI is positively related to the level of FDI to China. However, the share of Asia FDI in global FDI is highly negatively correlated to FDI to China. More generally, growth and inflation benefits from pegs might accrue only to less developed countries that are not well integrated with global financial markets, not more advanced countries. For EMEs growth or disinflation gains from pegging appear to be nullified by vulnerability to crises, which is why many emerging markets that used a peg as a nominal anchor now float.

production networks linking China and the rest of East Asia that appear to have enhanced the economic resilience of the region.

Third, how far is the bilateral exchange rate (eg vis-à-vis the dollar) targeted rather than the effective exchange rate? The creation of the euro brought forth a large single currency trading area, but it is not clear to what extent this has been reflected in exchange rate targets or foreign reserve portfolios outside Europe. China's and Japan's role in Asian trade is also important. For example, the growing production networks between China and the rest of Asia suggest that these countries need to pay increasing attention to their exchange rates relative to each other's currencies, rather than focusing exclusively on the US dollar. Also, the fact that Korea (for example) competes directly with Japan in third markets (including the Chinese market) can reasonably motivate assignment of a greater weight to won/yen fluctuations as opposed to won/dollar fluctuations. This will be particularly relevant during periods when the yen weakens against the dollar.

Fourth, how should an exchange rate band be designed (slope and central tendency, width)? On the one hand, a tight band can dampen short-run volatility, which can be important in a very open economy, while allowing considerable adjustment in the long run. On the other hand, structural changes (eg lower exchange rate pass-through, greater vulnerability to interest rate shocks due to higher household indebtedness) might imply that more exchange rate volatility would be acceptable in order to smooth interest rate fluctuations. Singapore provides an example of these trade-offs: a tighter band is seen as giving less leeway to speculative accounts drawn to the relatively good liquidity of the Singapore dollar foreign exchange market, but recent structural changes prompted a private sector proposal calling for a permanent widening of the Singapore dollar exchange rate band. In Israel, intervention attracted persistent capital inflows that needed to be sterilised. A significant adjustment to the intervention band (which still exists) permitted the Bank of Israel to stop intervening in June 1997, alleviating losses it had experienced from intervention (see Sokoler's contribution to this volume).

Fifth, what is the appropriate degree of transparency in an exchange rate target? On the one hand, transparency can help coordinate expectations and improve market efficiency. On the other hand, information about specific targets can trigger speculation. For example, Israel for a time targeted a publicly disclosed midpoint of a crawling band, but this led to speculative pressure, prompting the central bank to cease intervening as long as the exchange rate remained within the band. Hungary stopped disclosing its band (narrower than the ±15% allowed under the criteria for entry into the euro zone) because policymakers feared that markets would attack it. Singapore provides qualitative information on its band, but it does not disclose the precise width so as to deter speculative attacks. Similar considerations have prompted Hong Kong to maintain an asymmetric exchange rate target. There is a floor at 7.80 at which point the convertibility undertaking is triggered. However, there is no explicit target to limit currency appreciation. As noted by Pang in this volume, this makes it difficult for speculators to calculate the cost of shorting the Hong Kong dollar. For further discussion of tactical issues of intervention, see Archer's contribution to this volume.

The answers to the preceding questions may depend in part on the roles of the ministry of finance (or other government authorities) in exchange rate policy and intervention, and the extent do which their objectives differ from those of the central bank. In some countries, the ministry of finance would favour intervention to preserve competitiveness while the central bank would be more concerned with intervening in a way consistent with achieving its inflation goals. Disagreements of this kind appear to have had a significant impact on intervention in some cases; the extent may depend on arrangements discussed in more detail in Moser-Boehm's paper in this volume.

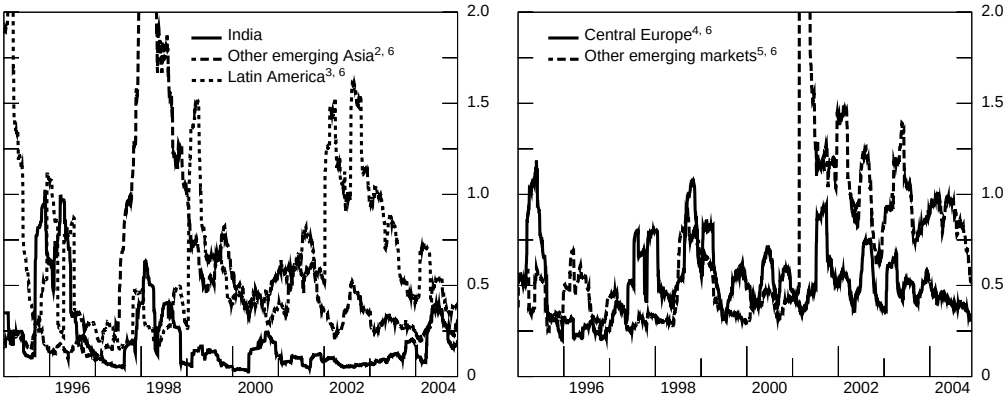
B. Intervention under floating

1. Higher exchange rate volatility

Since the collapse of pegged exchange rate regimes in the second half of the 1990s, many countries have switched to floating exchange rates with inflation targeting. Graph 2 reveals that high volatility during crisis episodes in the 1990s makes it hard to tell whether volatility has risen in recent years. However, a close examination of Graph 2 suggests that exchange rate volatility (against the US dollar) in emerging Asia (excluding China and India) and Latin America increased significantly in this decade, compared to periods of exchange rate stability in the 1990s (1995-96 in Asia, and 1996-98 in Latin America). Volatility has recently risen somewhat in India. Turning to the second panel, exchange rate volatility (against the euro) has remained roughly stable in central Europe, but has increased significantly since 2000 in other emerging markets.

Graph 2

Trends in daily exchange rate volatility[1]

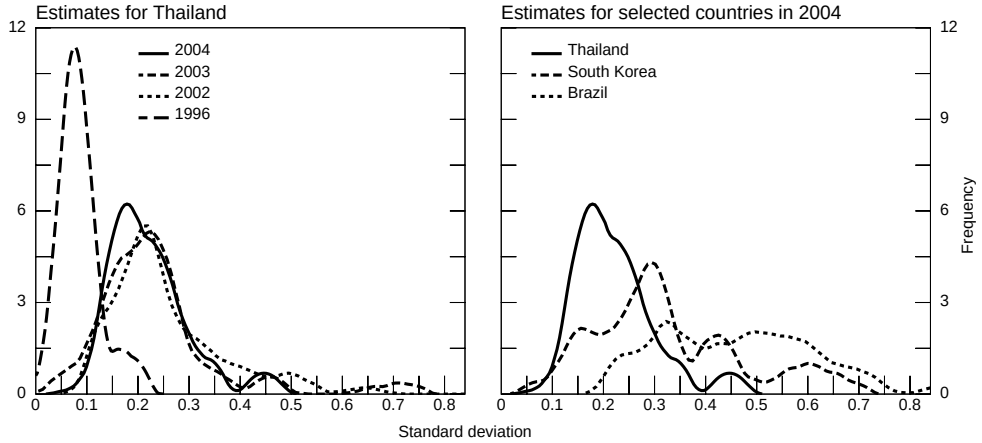


[1] Calculated as the 60-day rolling standard deviation of daily percentage changes in the exchange rate, where exchange rate is defined as the local currency against the euro for central Europe and against the US dollar for others. [2] Hong Kong SAR, Indonesia, Korea, Malaysia, the Philippines, Singapore, Taiwan (China) and Thailand. [3] Argentina, Brazil, Chile, Colombia, Mexico, Peru and Venezuela. [4] The Czech Republic, Hungary and Poland. [5] Israel, South Africa and Turkey. [6] Weighted average of the economies listed based on 2000 GDP and PPP exchange rates.

Sources: Datastream; ECB; BIS calculations.

Graph 3

Density estimates of 10-day rolling exchange rate volatilities[1]



[1] Estimated with Epanechnikov kernel using a bandwidth of 0.0483. 2004 estimates based on data up to end of October.

Source: BIS calculations.

Changes in volatility are revealed more clearly by shifts in the estimated densities of rolling daily standard deviations during years of relative tranquillity. To illustrate, in Graph 3, the left-hand panel shows that, for the baht/dollar exchange rate, the short-run average volatility that is apparently tolerated by the Thai authorities has increased considerably since 1996; the mass of the distribution has shifted to the right and there is also more mass at higher volatilities (the right tail of the density). On the other hand, there is a striking similarity in the estimated densities in recent years. The right-hand panel of Graph 3 reveals that in 2004 the estimated density for the Thai baht was still to the left of the Korean won's. The Brazilian real has been subject to much more volatility than either of these

two currencies: the density over the interval shown appears to be much flatter and the incidence of higher volatility is also greater. It may be noted that, in contrast, exchange rate volatility has actually *fallen* in recent years in some countries that have not actively intervened (Mexico and Israel), suggesting the presence of stabilising speculation.

Greater tolerance for exchange rate volatility is reflected in an apparent decline in intervention in foreign exchange markets in recent years (see Mihaljek's paper in this volume). One reason is that some economies are now more resilient to exchange rate fluctuations. Improved macroeconomic policies and policy credibility have reduced the short-term pass-through of exchange rate changes to inflation. At the same time, currency mismatches have declined (see Andersen and Moreno (2005), Graph 2), reducing the extent to which currency depreciation could weaken the financial sector and result in sharp contractions in output.

A second reason is that floating has advantages: it can prevent exchange rate overvaluation, and may help stabilise capital flows (see eg the papers in this volume by Özatay on Turkey and De Gregorio and Tokman on Chile, and Cifuentes and Desormeaux (2005)).

A third reason is that intervention can impose significant costs and may also have become less effective.[8] For example, foreign exchange market participants in one emerging market argued that tight limits on bank position-taking, the absence of speculators and regular intervention (once or twice a week, occasionally on both sides of the market within a week) reduced the scope for stabilising speculation and stunted market growth. It is also thought that very large foreign exchange market intervention designed to maximise the impact on the foreign exchange market has in some cases deterred private sector participation and impaired price discovery. The costs of these distortions tend to be higher in countries where financial markets are more developed. Intervention also tends to be less effective in more developed financial markets, where the substitutability of domestic and foreign assets is higher. This might explain why foreign exchange market intervention is now comparatively rare in developed countries other than Japan.

2. Intervention goals under floating

Although reliance on intervention appears to have declined under floating, policymakers are not entirely indifferent to exchange rate volatility. Questionnaire responses for the 2003 and 2004 Emerging Market Deputy Governors meetings indicate that intervention can at times recur over extended periods (weeks) and involve significant amounts. Under floating, intervention in part reflects the desire to preserve macroeconomic or financial stability (Table 1). For example, in 2002 sharp currency depreciation in Brazil was followed by a rise in inflation which required raising the inflation target. The central bank intervened and also raised interest rates. Emerging foreign exchange markets are also more prone to one-sided bets and instability, because they are thin and subject to a high degree of uncertainty and information asymmetries. Countries with high debts, currency mismatches or fragile financial sectors are particularly vulnerable.[9] In line with this, many countries cite lack of depth in the foreign exchange market as an important factor behind intervention. In principle, misalignment and external balance should be less of a concern under floating, but, as discussed below, in practice it appears to be an important reason for intervention.

Given these concerns, what do central banks target when deciding to intervene? Questionnaire responses and discussion at the meeting suggest that there is no single target under floating exchange rates. The immediate goals of intervention can include: (a) dampening volatility symmetrically; (b) countering excessive exchange rate movements or overshooting; (c) reducing the rate of change in the exchange rate ("leaning against the wind"); and (d) supplying liquidity to the market. In cases where the threat of disorderly markets is more immediate, concern about exchange rate movements becomes secondary and the primary goal is to supply liquidity to ensure the market keeps functioning. Some examples follow.

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[8] Other costs of intervention are cited by Mohanty and Turner's contribution to this volume.

[9] In contrast, in developed countries a main concern has been the potentially adverse effects of exchange rate volatility on international trade. The effects may be apparent only in the medium term and research has generally found these to be small. There are a number of reasons for this intervention, including to prevent sharp movements in tradable goods prices and resource misallocation that might arise.

(a) Dampening volatility symmetrically

On average, about 48% of respondents cited dampening exchange rate volatility as having been one of the immediate objectives of foreign exchange market intervention since the beginning of the decade. Views differ on conditions under which volatility should be a concern. One view is that policymakers should not dampen short-run volatility in foreign exchange markets, in order to encourage risk management and financial market development. In contrast, it is desirable to dampen volatility at longer horizons. For example, the Czech National Bank does not intervene in response to short-run daily exchange rate volatility, as measured by rolling standard deviations over a 60-day period. On the other hand, Bank Indonesia has intervened during periods when rupiah volatility has exceeded average annual volatility. Bank Indonesia considers the intervention effective if volatility falls (see Holub's and Bank Indonesia's respective contributions to this volume). In some situations, short-run volatility might be seen as potentially destabilising and might nevertheless trigger a response (see discussion of liquidity below).

(b) Preventing excessive exchange rate movements or overshooting

While expressing concerns about volatility, questionnaire respondents also indicated that they intervene to influence the level of the exchange rate. Over the period 2000-04, 28% of (22) respondents said they intervened for this reason. One explanation is that central banks seeking to dampen volatility will in many cases not respond to direct measures of volatility such as rolling standard deviations, but might intervene in response to "excessive" exchange rate movements instead. Such movements might be considered excessive because they reflect persistent deviations from equilibrium, or misalignment. In line with this, the Czech National Bank defines long-run volatility in terms of extreme fluctuations around a long-run trend. In 2004, the Reserve Bank of New Zealand introduced a similar criterion as the basis for possible intervention. Alternatively exchange rate movements might be considered excessive because of their impact on inflation or on financial stability.[10] For example, Mexico intervened in response to very large peso depreciation in September 1998 caused by the Russian crisis and the near collapse of Long-Term Capital Management, a US fund. Chile responded to large depreciations on two recent occasions (August to December 2001 and October 2002 to February 2003) by preannouncing total (but not daily) sterilised intervention amounts over each period and the form of intervention.[11] Colombia's volatility options are another example, as one of the goals of this mechanism is to avoid excessive *movements* in the exchange rate, in order to support achieving the inflation target. The concern with excessive exchange rate movements applies to large developed regions as well; in 2000 the European Central Bank intervened when exchange rate movements were thought to pose risks for price stability.

Other forms of foreign exchange market operations can also limit excessive exchange rate movements. South Africa has taken advantage of periods when there is a large influx of foreign currency liquidity in the market (eg due to large export receipts or investment transactions) to purchase foreign currency in order to build reserves; the effect would be to dampen possible spikes in the exchange rate. In some cases, central banks have engaged in *passive intervention* to prevent the foreign currency from reaching the market, eg when there are large revenues from foreign direct investment or from commodity exports. For example, the Mexican oil company Pemex can only acquire pesos by depositing its dollars in the central bank; it typically does this when it needs to meet its tax obligations. A similar mechanism to channel foreign currency privatisation revenues away from the foreign exchange market by depositing them in the central bank was set up in the Czech Republic (Sidaoui (2005) describes the case of Mexico, Holub in this volume the case of the Czech Republic, and Mihaljek (2005) provides a more general discussion).[12]

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[10] The distinction is made for purposes of clarity. However, it is not entirely straightforward, because central banks have multiple objectives and might also be concerned with external balance when trying to dampen excessive movements in the exchange rate. It is not always possible to tell what their real motivation is.

[11] The effect of sterilised intervention appeared to be small, but the effect of the announcement was large.

[12] One implication is that the transactions of the petroleum revenue stabilisation fund are entirely in local currency, so it poses no issues for foreign exchange market intervention. On the other hand, the oil stabilisation fund in Venezuela is maintained in US dollars by the central bank.

One participant suggested that central banks might cite volatility as their intervention goal when they are in fact concerned with deviations from equilibrium or the magnitude and direction of exchange rate movements. However, another participant stressed the importance of reassuring markets that the exchange rate level was not being targeted. Other participants said that volatility is worth monitoring separately for signs of disorderly markets, even when attention is paid to the exchange rate level.

(c) Leaning against the wind

Policymakers are typically concerned not just with how much the exchange rate might deviate from equilibrium but with how quickly it does so. Intervention will often attempt to *slow the rate of change in the exchange rate* without preventing trend changes, a policy that is known as "leaning against the wind". While intervention of this kind typically occurs when the exchange rate is moving away from equilibrium, it can sometimes occur if the exchange rate is moving back to equilibrium, but "too quickly". Slowing the rate of change in the exchange rate can stop herding behaviour by acting as a circuit breaker. By reducing uncertainty, this type of intervention may facilitate foreign exchange market development and enhances the availability of hedging instruments (eg for agents in the tradable goods sector). On the other hand, by acting as a provider of "insurance" against rapid exchange rate movements, official intervention could also undermine incentives for the development of hedging capability in the private sector. As reported by participants at this meeting, this has been the experience of Chile, Israel and Mexico.

On average over the last five years, 19% of respondents to the questionnaire indicated that they practice "leaning against the wind". For example, "volatility" options used by the central bank of Colombia are also designed to moderate excessive and abrupt movements in the exchange rate from its recent trend that could lead to changes in expectations that drive the exchange rate away from its fundamentals (see Uribe's paper in this volume and Uribe (2005)). Leaning against the wind is described as the main focus of intervention in Peru, and was used to calm markets and dampen volatility during a period of exchange rate pressure in 2002 (reflecting investor risk aversion and political uncertainty in Brazil). More recently, intervention has been used to smooth appreciation pressures (see Armas's paper in this volume).

(d) Supplying liquidity (or serving as market-maker of last resort)

Episodes of financial stress can trigger intervention. On average, 21% of the respondents to the questionnaire indicated that they intervened in response to extreme events, while 55% said they intervened to curb excessive exchange market speculation. During such periods, liquidity can collapse among market-makers, with severely impaired price discovery and problems in getting private transactions executed. Maintaining convertibility is the prime objective of this type of intervention, which is consistent with preserving financial stability and preventing crises. Intervention might also have the desirable effect of limiting the extent of overshooting that might result from the disappearance of liquidity by restoring effective price discovery, although this is not the main objective.[13] Among the respondents to the questionnaire, 41% indicated that they had intervened to provide liquidity in thin foreign exchange markets. For example, Brazil and Korea have intervened during periods of foreign exchange market volatility triggered by political uncertainty to supply liquidity to foreign exchange markets and fill gaps between bids and offers in this market (see eg Rhee's paper on Korea in this volume). In Brazil, intervention was accompanied by the issuance of foreign currency-linked debt as a hedging instrument. The effect was the continued operation of the foreign exchange market under conditions in which it otherwise might have collapsed.

C. Influencing the amount of foreign reserves

Another motive for central bank operations in the foreign exchange market is to influence the level of foreign exchange reserves. Many central banks have sought to accumulate reserves, a policy more or less continuously followed by a number of Asian economies since the crises of the late 1990s and

[13] In extreme cases where the foreign exchange market has become extremely illiquid as a result of withdrawal of market-making by shell-shocked financial institutions, central banks/governments might choose to supply foreign exchange at off-market prices to shelter domestic firms from being forced either to default or to settle obligations at ruinous prices.

more recently by a number of Latin American central banks. Others have sought to reduce the growth in or the level of reserves (Mexico and Chile). Three broad considerations may guide the criteria and choice of instruments for, and tactics used in, regulating the amount of reserves: (a) exchange rate impact; (b) market friendliness; and (c) costs versus benefits.

(a) Exchange rate impact

While the goal of other types of central bank participation in the foreign exchange market cited above is to maximise the impact on the exchange rate, the goal when seeking to influence the amount of reserves is to *minimise* this impact. There is keen awareness of this issue in a number of emerging market central banks. For example, both Mexico and Colombia have used options mechanisms for regulating the amount of foreign reserves to ensure that the central bank does not accumulate reserves when the domestic currency is under depreciation pressure (see Sidaoui (2005) and Uribe (2005) for descriptions). Mexico's use of a preannounced formula to limit the growth in foreign reserves and the policy of spreading out foreign currency sales on a daily basis over a period of time would also tend to minimise the exchange rate impact. Turkey has used preannounced, rule-based foreign exchange purchase auctions to accumulate foreign reserves. South Africa's policy of "creaming off" uses another approach to limit the exchange rate impact, as reserves are accumulated during periods when the market is flush with foreign liquidity (see Özatay's paper on Turkey and the paper contributed by South Africa for this volume).

(b) Market friendliness

This is important because government policies can impair foreign exchange market development and price discovery. One issue is the size of the central bank presence in the foreign exchange market, which as suggested earlier can discourage private sector participation. By this criterion, policies that minimise the exchange rate impact of central bank operations to influence reserves would tend to be market friendly. Another issue is the use of supplementary measures, such as foreign exchange controls, to ensure foreign reserves are channelled to the central bank. This is an issue in emerging market economies that impose foreign exchange surrender requirements.

(c) Costs and benefits

A primary consideration in any decision affecting the level of reserves is the marginal costs of an additional dollar of reserves against the marginal benefits, an issue that has been explored by a number of central banks (eg Chile and Mexico).[14] For example, if the impact on competitiveness is not a consideration, the marginal benefit of an additional dollar in foreign reserves could be estimated as the expected reduction in the cost of a currency crisis based on early warning system estimates (ie the change in the probability of a crisis associated with an increase in reserves times the cost of a crisis) while the marginal cost is the opportunity cost of holding reserves (eg the sovereign spread - which assumes reserves are financed by foreign borrowing - times the change in reserves).

Assessing marginal benefits in this way is a step beyond traditional measures of reserve adequacy which are based on rules of thumb, of which there are now many. For example, De Beaufort Wijnholds and Kapteyn (1999) suggest that the traditional benchmark, reserves to imports, is obsolete and the emphasis should be on coverage for possible flight from the banking system (reserves to M2), or to the possibility that short-term external financing will dry up (reserves to short-term debt, also known as the Guidotti rule). Reserve holdings are presented in terms of these three benchmarks in Table 2.

[14] See Sidaoui (2005). Some of the discussion also drawns on points made by Esteban Jadresic of the Central bank of Chile at a central bank workshop in Brasilia in 2004.

Table 2

Foreign exchange reserves and measures of adequacy

	Foreign exchange reserves:							
	Outstanding year-end position[1]		As a percentage of					
			Imports		Broad money		Short-term external debt[2]	
	1994	2003	1994	2003	1994	2003	1994	2003
Asia, large economies[3]	188	862	57	109	12	19	215	687
China	52	403	45	98	9	15	267	1,300
India	19	98	72	139	13	25	257	598
Korea	25	155	24	86	7	21	60	289
Taiwan, China	92	207	108	161	20	33	485	835
Other Asia[3]	71	132	43	59	25	32	113	294
Indonesia	12	35	37	105	15	31	54	258
Malaysia	25	43	42	54	40	39	355	416
Philippines	6	13	28	36	18	30	179	121
Thailand	29	41	53	55	26	29	92	404
Latin America[3]	92	171	54	60	20	29	85	137
Argentina	14	13	64	95	26	34	63	55
Brazil	37	49	112	102	24	35	128	124
Chile	13	15	120	86	78	46	197	138
Colombia	8	10	65	73	51	44	151	277
Mexico	6	58	8	34	3	18	16	157
Peru	7	10	125	119	77	54	304	164
Venezuela	7	16	83	156	50	82	172	493
Central Europe[3]	19	73	38	48	24	37	271	240
Czech Republic	6	27	36	53	22	40	304	473
Hungary	7	12	46	25	35	29	202	98
Poland	6	34	34	64	19	38	367	274
Israel	7	26	29	75	12	22	358	438
Russia	4	73	8	97	14	67	22	284
South Africa	2	6	8	18	3	6	19	63
Turkey	7	34	31	49	22	32	80	148
All countries above[3]	391	1,377	47	83	15	23	129	354
Memo:								
Australia	*11*	*30*	*20*	*34*	*6*	*7*	*21*	*24*
Japan	*115*	*653*	*42*	*170*	*2*	*10*		*235*
Sweden	*23*	*18*	*43*	*22*	*24*	*12*		*15*

[1] In billions of US dollars. [2] Short-term external debt defined as short-term liabilities to BIS reporting banks: consolidated cross-border claims of all BIS reporting banks on countries outside the reporting area with a maturity up to and including one year plus international debt securities outstanding with a maturity up to one year. [3] Sum or average of the countries shown.

Sources: IMF; national data; BIS.

As for costs, they depend in part on the level of reserves and how intervention is financed. Research suggests that higher foreign reserves can reduce sovereign spreads as well as improve credit ratings (Moreno and Turner (2004)). Thus the costs of holding reserves can narrow through this channel as reserves rise. At the same time, whether foreign reserves are financed by money creation, by the issuance of central bank instruments, by the sale of government securities or by foreign borrowing has different implications for currency and duration exposures, the profitability of the central bank and overall costs. The choice of financing also influences who bears the cost: the public at large through inflation or taxation or the central bank. Except in countries with pegged exchange rates, policymakers cannot generally finance foreign reserve accumulation through money creation without undermining domestic policy objectives (ie the importance of sterilising intervention is widely recognised). Some countries resort to foreign currency financing of foreign reserve purchases, in part to limit the direct impact of reserve accumulation on the central bank income statement. Others rely on financing of foreign reserve purchases through the sale of treasury securities or the issuance of central bank securities. This can raise the cost of financing recorded in central bank statements, but reduce the net external indebtedness position of the government and overall currency mismatches in the economy. Some of the implications of intervention are discussed by Mohanty and Turner's paper in this volume.

There are no available cross-country studies comparing marginal costs to marginal benefits of foreign reserve accumulation. However, recent measures to reduce foreign reserve holdings and to limit foreign reserve growth suggest that in some Latin American countries (Chile, Mexico) the costs of holding additional foreign reserves exceed the benefits. In contrast, a number of Asian countries with much higher foreign reserve levels do not appear to consider a reduction in reserve holdings a priority.[15] The reasons for the contrasting reserve levels also warrant further research. Possible explanations include relatively low interest rates in Asia (which reduce marginal costs of reserve acquisition); foreign reserve accumulation as a by-product of other policies, such as a desire to influence the exchange rate in order to preserve competitiveness; and political economy considerations. These last issues may arise when large-scale foreign exchange reserves appear as a highly visible and apparently freely available resource for politicians to spend on public works. Some recent research suggests that it is optimal to hold lower foreign reserves if the government is more inclined to spend them (Aizenman and Marion (2004)).

III. Conclusion

Central banks intervene in foreign exchange markets to achieve a variety of maroeconomic objectives, such as controlling inflation, maintaining competitiveness or maintaining financial stability. However, the specific motives for intervention are likely to change with their level of economic and financial development. Central banks in countries at earlier stages of development often intervene to support a pegged exchange rate, and are also more likely to function as "market makers", supplying liquidity in less developed foreign exchange markets. More advanced emerging markets have generally adopted flexible exchange rates and intervention is more likely to focus on dampening exchange rate volatility. Central banks thus enter the foreign exchange market to prevent overshooting or slow the speed of adjustment in the exchange rate, and to supply liquidity during periods of financial stress. Central banks also enter the foreign exchange market to regulate the amount of foreign exchange reserves, either to accumulate the hard currency needed for intervention, or to reduce reserves in order to lower carrying costs.

[15] This is the case even if foreign reserves in Asian economies already exceeded a popular liquidity benchmark (the Guidotti rule) by 1999. The IMF (2003) finds that reserve holdings in Asia exceeded those predicted by a set of determinants of demand for reserve holdings.

Annex
Two definitions of intervention: narrow versus broad

There are two views on how foreign exchange market intervention should be defined. One is that the definition should be *narrow*: central bank transactions in the foreign exchange market should be called "intervention" only if (1) they are sterilised, ie are offset by central bank transactions that nullify any impact on domestic money creation (unsterilised intervention would then be considered monetary policy); (2) the purpose is to influence the exchange rate.[16] Sterilised intervention would be viewed as distinct from monetary policy, and multiple goals that could otherwise be in conflict can be achieved.

Excluding central bank operations that are not intended to influence the exchange rate can rule out a number of transactions that might have no underlying stabilisation policy goal, such as small technical transactions, foreign reserve purchases financed by foreign currency borrowing, or transactions that are similar to those of other economic agents and are related to underlying economic activities (eg using foreign reserves to purchase a piece of equipment on behalf of the government). In some cases central banks do not consider as intervention transactions that are mainly intended to regulate the amount of foreign reserves, particularly if they are automatic or based on rules, rather than discretionary. For example, Mexico's operations to limit the growth in reserves by selling foreign currency according to a predetermined formula are arguably not intervention as narrowly defined.

However, focusing exclusively on a narrow definition of intervention can lead one to overlook important policy issues, particularly in emerging market economies. First, central bank operations in emerging foreign exchange markets are often not (immediately) sterilised or the instrument used in sterilisation might be of short duration.[17] Indeed, many central banks *have relied on operations in the foreign exchange market as a way to implement monetary policy,* which would imply not sterilising at all. Even when the exchange rate is floating, central banks sometimes prefer to intervene in the foreign exchange market rather than conduct an open market operation to achieve a monetary policy objective.[18] Understanding the motives for and characteristics of central bank operations in the foreign exchange market under these conditions is of considerable policy interest, whether the operation is labelled intervention or not.

Second, central bank foreign exchange transactions can affect the exchange rate even if this is not the primary intention. For example, in pursuing its policy of reserve accumulation, the South African Reserve Bank (SARB) tries to limit the impact on the exchange rate by entering the market only when large supplies of foreign currency become available. It is also "quiet": it does not announce its transactions in real time (they can be inferred ex post, from the central bank balance sheet), and will typically not initiate large transactions but will wait for holders of foreign currency to offer it to the SARB. However, the transactions are large, so it is likely that the impact on the exchange rate is significant, even if this is not the primary purpose (see discussion in this paper). Reserve accumulation can also affect the exchange rate because of its impact on sovereign ratings and spreads (Moreno and Turner (2004)). Mihaljek's paper in this volume reports that a significant number of central banks find some positive impact of reserve accumulation on sovereign credit ratings.

Some therefore favour a *broad* definition of foreign exchange market intervention. A widely cited central bank working group report acknowledges that intervention is usually undertaken to influence the exchange rate, but defines it as "any sale or purchase of foreign exchange against domestic currency which monetary authorities undertake in the exchange market" (Jurgensen (1983)). This

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[16] On the other hand, one participant whose currency is pegged argued that day-to-day operations in which the central bank supplies foreign exchange or accumulates foreign reserves should not be considered intervention. The term intervention should in this view be reserved for exceptional cases.

[17] For a general discussion of sterilised intervention and its limits, see Mohanty and Turner's paper in this volume.

[18] The reasons underlying the choice between the foreign exchange market and the domestic money market to implement policy warrant further investigation, but it is apparent that the foreign exchange market will be preferred when the benefits exceed the costs. For example, one participant noted that during an episode of sharp depreciation that threatened the inflation target by influencing inflation expectations, a very sharp rise in interest rates would have been required to stabilise the exchange rate. Intervention in the foreign exchange market was seen as preferable under these conditions.

applies to intervention in spot or forward markets, regardless of the form of financing (reserves, swaps, borrowing, etc).

An even broader definition includes "passive" interventions. Here the central bank takes foreign currency directly from public or private entities outside the market, in some cases as a result of surrender requirements. A traditional reason for such intervention is that the government wishes to control the allocation of foreign reserves. Another reason is to insulate the foreign exchange market from the impact of very large foreign exchange flows (ie to dampen exchange rate volatility).[19] Some emerging market examples are discussed in this paper. Adams and Henderson (1983, page 3) argue that "such direct dealings of central banks, sometimes called 'passive' intervention, are actually as active as an effort to affect the ultimate relative supplies of securities denominated in different currencies as conventional operations are; they should therefore be included in a comprehensive intervention measure". One implication of adopting a broad definition is that changes in foreign reserves (adjusting for exchange rate valuation effects) can be interpreted as closely reflecting intervention.

To sum up, there are pros and cons to adopting either the narrow or broad definition of foreign exchange market intervention. In practice, each central bank adopts the definition that it considers most appropriate for its purposes. The discussion in this volume therefore extends beyond the narrow definition of foreign exchange market intervention to include a range of central bank operations in the foreign exchange market.

[19] There are still other measures governments adopt outside the foreign exchange market that can influence the exchange rate. For example, during periods of exchange market pressure, the Brazilian government has issued domestic currency debt linked to the exchange rate that has been used as a hedging instrument. However, this does not directly involve a sale or purchase of foreign exchange.

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